REMARKS

Claims 16-30 and 35-38 are pending in this application. The applicant respectfully requests reconsideration of the outstanding rejections in view of the amendments above and the following remarks.

Drawing Objections

The examiner has objected to the drawings under 37 CFR 1.83(a) as failing to show every feature of the invention specified in the claims.

With respect to the method claims, the applicant submits that drawings are not necessary for an understanding of the claimed subject matter. The applicant notes the documented USPTO practice of treating method claims as claims for which a drawing is not necessary for an understanding of the invention under 35 USC 113 (first sentence).[1] The applicant further notes that the method claims as presented here are amply supported by the written description, details of which are provided below. In view of the foregoing, the applicant respectfully requests that this objection be withdrawn with respect to the method claims.

With respect to the device claims, the examiner has specifically requested corrections to support the recitation of a "data source and a transmitter, the transmitter configured to receive "the transmit signal" from the modulator for transmission to the signal space." The specification and drawings clearly already identify a transmitter (110) that receives data from a modulator (10). The applicant has modified the drawings and specification to show that the "input data" in Fig. 1 comes from a data source (15). In view of the foregoing amendments, the applicant respectfully requests that this objection be withdrawn.

Claim Rejections - 35 U.S.C. §112

The examiner has rejected all of the pending claims as failing to comply with the written description requirement of 35 U.S.C. §112. As detailed in the following

[1] MPEP 608.01(f). While the applicant acknowledges that the actual request was made under 37 CFR 1.83(a) and relates to the drawings requirement under 35 USC 113 (second sentence), the applicant submits that as a legal matter the *need* for a drawing to support a method claim is the same under either portion of the statute, and no further drawings should be required for the method claims in this case.

comments, the originally filed provisional application conveys the scope of the applicant's invention and describes the presently claimed invention in sufficient detail so that one skilled in the art could reasonably conclude that the applicant had possession of the invention at the time the provisional application was filed. Further, the provisional application provides adequate support for the claim language. In this respect, the examiner is reminded that literal support is not absolutely required[2], but that the disclosure should be viewed in its entirety to determine how the applicant provides support for the claimed invention.[3] In particular, mere rephrasing, rewording, or inclusion of dictionary or art recognized definitions do not constitute the addition of new matter.[4]

In the present case, the description in the provisional application might have been drafted differently, but it clearly discloses transmissions using variable frequency ranges and integration times to define "tiles" with a phase coherency that can carry data in a wireless system. "The time-frequency block can be tailored to fit virtually any channel conditions and frequency allocations available...."[5] An embodiment of this subject matter is set out in each of the present independent claims. The applicant submits that the language of the pending claims is fully supported by the specification, which describes the invention in adequate detail for one of skill in the art to understand the invention. The applicant therefore requests reconsideration of this rejection in view of the following detailed remarks which identify specific supporting passages for the present claim limitations.

As used in the following description, "utility application" refers to the present application, U.S. App. No. 09/802,280 filed on March 8, 2001. As used in the following description, "provisional application" refers to U.S. App. No. 60/188,084 filed on March 9, 2000 which was incorporated by reference in its entirety in the utility application. It will be appreciated that throughout the following analysis, the selection of specific instances of supporting language does not in any manner suggest that the cited passages are the only supporting language, or the best supporting language, for the claim limitation

[2] "[T]here is no *in haec verba* requirement." MPEP 2163(I)(B).
[3] MPEP 2163 (II)(A)(2), et seq.
[4] MPEP 2163.07 (I).
[5] U.S. App. No. 60/188,084, page 1.

at issue, nor should the selection of specific passages below be interpreted as defining the scope of the claimed subject matter. Rather, the supporting passages are instances or embodiments of the claimed subject matter and the claims should be interpreted in the broadest sense allowable by law.

Claim 16 recites:

> 16. A method of transmitting a wireless signal comprising:
> identifying a signal space for wireless communication, the signal space including a range of frequencies;
> creating a waveform for the signal space, the waveform organized into a plurality of sub-bands, each one of the plurality of sub-bands defined by one of a plurality of time-frequency tiles characterized by a bandwidth and an integration time;
> adapting at least one of the bandwidth and the integration time of one of the plurality of the time-frequency tiles to provide a channel having a tile size selected to maintain a predetermined phase coherency across the time-frequency tile;
> modulating a data signal onto the waveform using direct sequence spreading for each one of the plurality of sub-bands, thereby providing a transmit signal; and
> transmitting the transmit signal into the signal space.

The limitations of this claim are now addressed in detail.

identifying a signal space for wireless communications -

This language finds support at least in page 2 of the provisional application, which provides in part:

> The fundamental FD-DSS waveform utilizes a two dimensional time/frequency plane for data and spread spectrum chip modulation. The figure below illustrates its **signal space**.[6]

The corresponding figure is shown below:

[6] U.S. App. No. 60/188,084, page 2 (emphasis added).

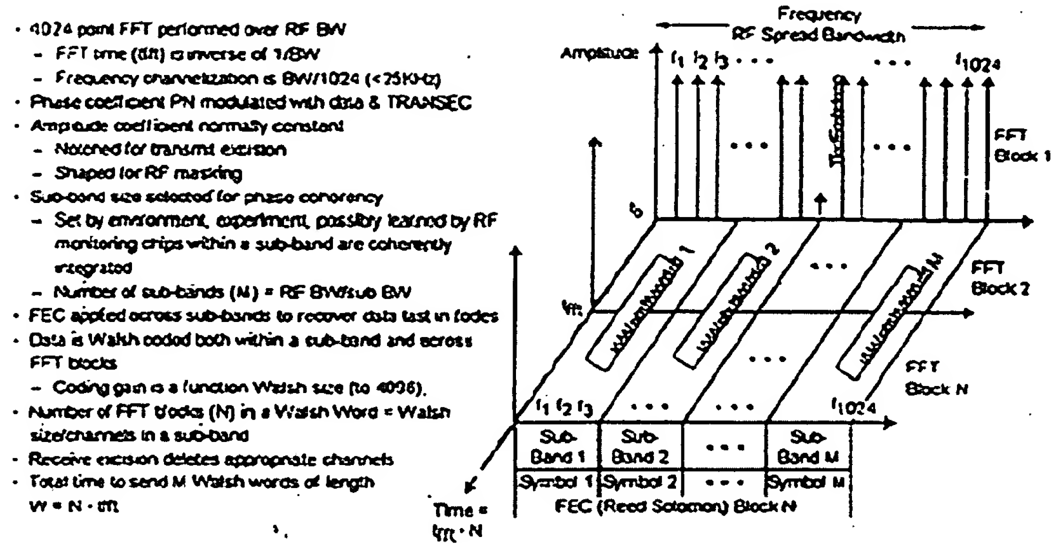

Fig. appearing on page 2 of the provisional application

Thus a signal space (which in a disclosed embodiment includes a two dimensional time/frequency plane) is clearly identified in this language and in the associated drawing as the particular signal space used in the various wireless communications described in the provisional application. This language is substantially repeated in the utility application:

> The fundamental FD-DSS novel waveform utilizes a two dimensional time/frequency plane for data and spread spectrum chip modulation. FIG. 1A illustrates its ***signal space.***[7]

This passage refers to FIG. 1A of the utility application, which also corresponds to the drawing contained in the provisional application. Fig. 1A of the utility application is set out below:

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[7] U.S. Pub. No. 02/0136276, par. [0034] (emphasis added).

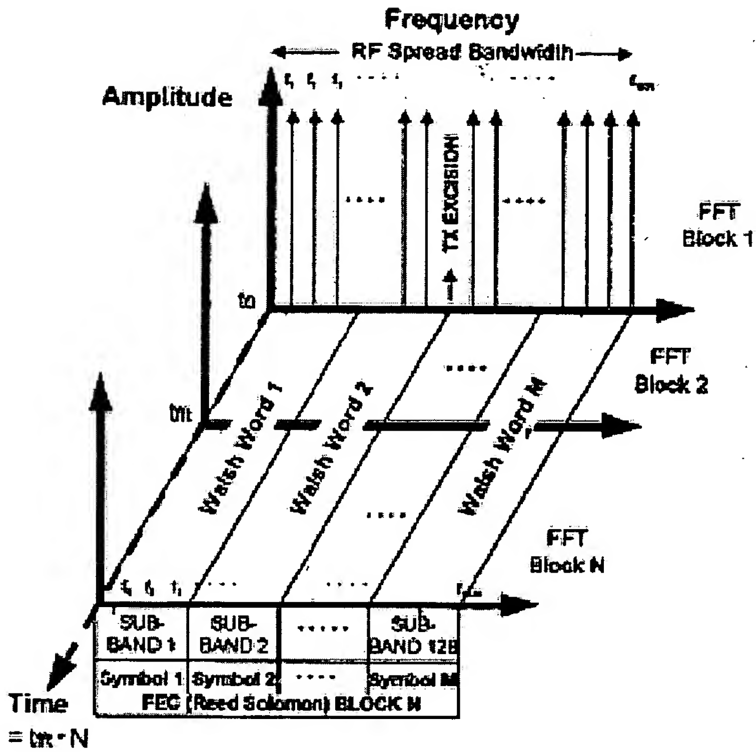

Fig. 1A of the utility application

This claim language is clear, and is supported by the originally filed provisional application and the later-filed utility application (which incorporates the provisional application in its entirety).

the signal space including a range of frequencies

The range of frequencies for the signal space is inherent in the "two-dimensional time/frequency plane" that defines the signal space. This range is also clearly illustrated in the figures above, which depicts the amplitude for a number of discrete frequencies (shown as vertical lines with arrowheads) within an "RF Spread Bandwidth". The provisional application further provides an annotation for this figure noting channelization within this range of frequencies at a bandwidth of about 25 kHz: "Frequency Channelization is BW/1024 (<25 kHz)".[8] Other indirect references to this

[8] U.S. App. No. 60/188,084, page 2.

range of frequencies can be found throughout the provisional application and the utility application.[9]

creating a waveform for the signal space

Figure 1 of the utility application describes the apparatus required for creating the waveform. This figure is reproduced below.

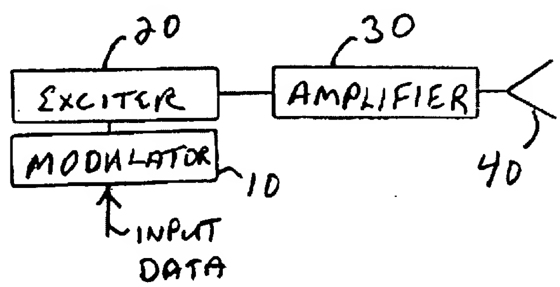

Fig. 1 of the utility application

Data is input, modulated, excited, amplified, and fed into an antenna. The utility application states:

> [I]nput data signal is encoded and modulated using a novel spread spectrum waveform as described hereinafter and a resulting modulated signal is fed to an exciter 20. The exciter 20 up converts the modulated signal to a transmit frequency signal and feeds the transmit frequency signal to an amplifier to increase the power of the signal. The output signal from the amplifier is then fed to an antenna 40 for propagating a transmit RF signal....[10]

Thus, based on the signal space which has been previously defined, the waveform needed for this signal space is created as described in this paragraph.

the waveform organized into a plurality of sub-bands

This language finds support at least in that the sub-bands are described in relation to Frequency Division Sequence Spectrum Spreading (FD-DSS) according to the following:

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[9] **See, e.g.,** U.S. Pub. No. 02/0136276 par. [0024] ("Spread spectrum processing gain spreads the information across a large transmission bandwidth . . .") and par. [0031] ("The 1024 carriers are grouped into coherent subbands of contiguous frequencies.").
[10] U.S. Pub. No. 02/0136276, par. [0021].

> [T]he **sub-bands are** not narrowband fixed channels, but rather, **flexible time-frequency channels** that allow direct sequence spectrum spreading with large order M-ary coding across both dimensions simultaneously. Variable coherent integration times, bandwidths, M-ary alphabet sizes, data rates, and processing gains allow adaptive matching or selection of the most efficient signal format for the channel conditions ... encountered on each link in a decentralized changing network. **Redundancy across sub-bands is provided** by forward error correction (FEC) coding across sub-bands and a sub-band quality measure step detects and erases corrupted frequency sub-bands before FEC decoding. **Faded sub-bands are de-emphasized** (i.e. erased) in the decoding process, while the full information set is recovered from the surviving strong sub-bands, which may even be SNR enhanced by multipath.[11]

Thus the specification clearly describes that there are multiple sub-bands for the generated waveform. The specification also describes these sub-bands and the benefit of using them according to the disclosed invention.

each one of the plurality of sub-bands defined by one of a plurality of time-frequency tiles

The tiles are portions of the two-dimensional time / frequency plane discussed earlier. The concept of tiles is communicated according to the provisional application's statement "the sub-bands are ... flexible time-frequency **tiles**."[12] The term tiles, further, is a well understood concept, commonly used by those of skill in the art before and at the time of the application being filed.[13,14] While the term "tiles" is used in the provisional application the term "channels" is used in the utility application. The terms tiles and channels should be considered interchangeable.

characterized by a bandwidth and an integration time

Fig. 1A of the provisional application, as shown earlier, displays the tiles in the x-axis and z-axis where the x-axis is the frequency RF spread spectrum bandwidth and the

[11] U.S. Pub. No. 02/0136276, par. [0023] (emphasis added).
[12] U.S. App. No. 60/188,084, page 2 (emphasis added).
[13] Farrell, T.C.; Prescott, G., "A low probability of intercept signal detection receiver using quadrature mirror filter bank trees," 1996 ICASSP Conference Proceedings, Volume 3, May 7-10, 1996, vol. 3, pp. 1558-61 (see at least page 1561 last paragraph and figure 3)
[14] Nayebi, K.; Sodagar, I.; Barnwell, T.P., "The wavelet transform and time-varying tiling of the time-frequency plane," Time-Frequency and Time-Scale Analysis Proceedings, 1992, Oct. 4-6, 1992, pp. 147-50 (see at least title, abstract, and figure 1)

z-axis is time. The utility application further describes this as follows:

> The fundamental FD-DSS novel waveform utilizes a **two dimensional time/frequency plane** for data and spread spectrum chip modulation. FIG. lA illustrates its signal space. Each data symbol occupies a **time-bandwidth** product that typically spans less than the entire allocated **bandwidth** (BW). The channel is partitioned into sub-bands, each with limited coherent integration **bandwidth.** Fitting the coherent BW bandwidth of the signal to no more than the channel supports is a key to achieving high multipath resistance. For HF that bandwidth may be only one KHz, at VHF maybe 100 KHz. In general, the emphasis is to **integrate longer in time**, but over shorter sub-bands. Thus, each sub-band becomes a single frequency bin, **integrated over a full data bit time**, but there is no spread spectrum processing gain across frequency.[15]

adapting at least one of the bandwidth and the integration time of one of the plurality of the time-frequency tiles to provide a channel having a tile size selected to maintain a predetermined phase coherency across the time-frequency tile

Adapting of a bandwidth or an integration time for a tile/channel is described in the utility application by the following:

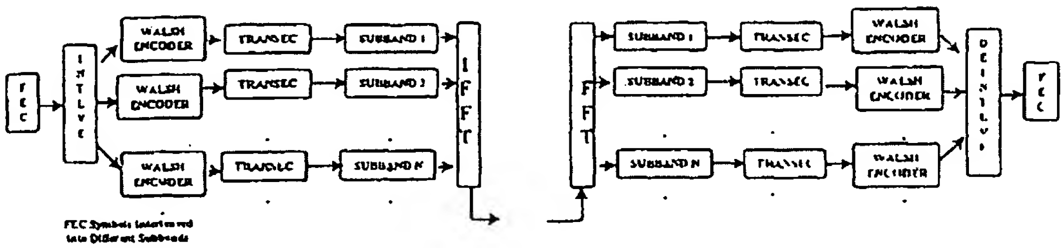
> **Variable coherent integration times, bandwidths**, M-ary alphabet sizes, data rates, and processing gains **allow adaptive matching** or selection of the most efficient signal format **for the channel conditions**....[16]

modulating a data signal onto the waveform

The transmitter portion of the sub-band utilization is shown in the left hand portion of a figure from the provisional application.

[15] U.S. Pub. No. 02/0136276, par. [0034] (emphasis added).
[16] U.S. Pub. No. 02/0136276, par. [0023] (emphasis added).

Two Methods for Subband Utilization



1. Interleave FEC Symbols among Subbands to Decorrelate the Error Probabilities among Symbols within an FEC Word

Fig. portion appearing on page 3 of the provisional application

A substantially similar figure portion appears in the utility application as Fig. 2A. A redacted Fig. 2A is shown below which focuses on the transmit portion of the system.

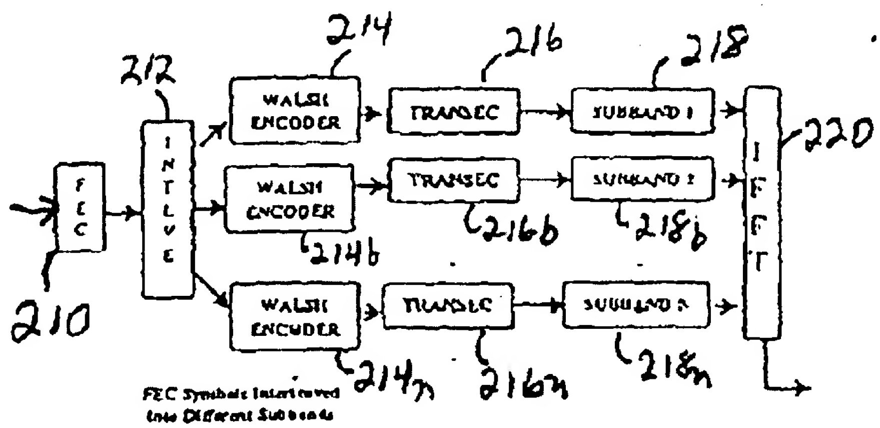


Fig. 2A portion from utility application.

A description of the modulation as utilized in the Fig. 2A is further covered below:

> As with any **modulation technique, transmission of information requires data to be impressed onto the FD-DSS modulation**. Two techniques for impressing baseband data onto the subband modulation are illustrated in FIGS. 2A and 2B, respectively. The first technique requires no equalization and therefore requires neither equalizer convergence nor tracking. The second technique makes use of an adaptive equalizer and requires both equalizer convergence and tracking. In the first technique as shown in FIG. 2A, the digital data is encoded with a Forward

> Error Correction (FEC) code as shown by FEC block 210 prior to **modulation,** for example a Reed Solomon FEC code can be used.... The output of the respective subband filters 218, *218b ... 218n* are fed to an Inverse Fast Fourier Transform (IFFT) 220 wherein the signal is fed to the exciter 20.[17]

In the provisional and utility applications, much further material is utilized in the description of the modulation techniques.

using direct sequence spreading for each one of the plurality of sub-bands

The provisional application discusses the use of direct sequence spreading in the following section:

> FD-DSS resembles OFDM in principle, except that the **sub-bands** are not narrow band fixed channels, but rather, flexible time-frequency tiles (grids) that allow **direct sequence spectrum spreading**....[18]

thereby providing a transmit signal; and transmitting the transmit signal into the signal space.

A transmit signal is included in both the provisional and utility patent applications. Once a signal space has been defined, a signal must be transmitted into this signal space. One description of the transmit signal is shown below.

> The exciter 20 up converts the modulated signal to a **transmit** frequency **signal** and feeds the **transmit** frequency **signal** to an amplifier to increase the power of the signal. The **output signal from the amplifier is then fed to an antenna** 40 for **propagating a transmit RF signal**....[19]

Thus the claim language of claim 16 is clear and is supported by the originally filed provisional application and by the subsequently filed utility application, which incorporates the provisional application in its entirety.

Claim 17 recites:

> 17. The method of claim 16 wherein creating a waveform includes adding a preamble that includes an indication of the bandwidth and the integration time of at least one of the plurality of time-frequency tiles.

[17] U.S. Pub. No. 02/0136276, par. [0038] (emphasis added).
[18] U.S. App. No. 60/188,084, page 1 (emphasis added).
[19] U.S. Pub. No. 02/0136276, par. [0021] (emphasis added).

The use of a preamble generally is described, for example, in the provisional application where it refers to a "rapid acquisition preamble approach"[20] to encoding data. The use of this preamble to embed information concerning the waveform is described for example as "Rapid fast-convolution acquisition and self discovery."[21]

Claim 18 recites:

> 18. The method of claim 17 wherein the preamble includes an indication of one or more of an M-ary alphabet size and a data rate for the at least one of the plurality of time-frequency tiles.

M-ary alphabets and variable data rates are discussed for example in the following passage:

> Variable coherent integration times, bandwidths, M-ary alphabet sizes, data rates, and processing gains allow adaptive matching or selection of the most efficient signal format for the channel conditions....[22]

Claim 19 recites:

> 19. The method of claim 18 wherein at least one of the m-ary alphabet size and the data rate vary over time.

Both the provisional application and the utility application clearly teach a varying M-ary alphabet size and a varying data rate. The utility application states: "**Variable** coherent integration times, bandwidths, **M-ary alphabet sizes, data rates**, and processing gains allow adaptive matching or selection of the most efficient signal format for the channel conditions...."[23]

Claim 20 recites:

> 20. The method of claim 19 wherein the M-ary alphabet size and the data rate vary from burst to burst in a packetized data system.

[20] U.S. App. No. 60/188,084, page 1.
[21] U.S. App. No. 60/188,084, page 1; U.S. Pub. No. 02/0136276, par. [0023].
[22] U.S. Pub. No. 02/0136276, par. [0023].
[23] U.S. Pub. No. 02/0136276, par. [0023] (emphasis added).

Varying M-ary alphabet size and data rate are specifically described in the provisional application at least as follows:

> [S]ub-bands are not narrowband fixed channels, but rather, flexible time-frequency tiles (grids) that allow direct sequence spectrum spreading with large order M-ary coding across both dimensions simultaneously. Variable coherent integration times, bandwidths, M-ary alphabet sizes, data rates, and processing gains allow adaptive matching/selection of the most efficient signal format to the channel conditions (multipath, interference, jamming) encountered on each link in a decentralized fluid network.[24]

The use of bursts for transmitting this varying data is more specifically described in at least the following text, which specifies both the technique for communicating (rapid fast-convolution acquisition and self discovery) and the nature of the communication (burst mode channel sharing), as well as one of the advantages relative to other techniques (no equalizer/RAKE training):

> Rapid fast-convolution acquisition and self discovery affords immediate reception without equalizer/RAKE training for efficient burst-mode channel sharing operation in multi-terminal ad hoc networks.[25]

Similar language appears in the later-filed utility application.[26]

Claim 21 recites:

> 21. The method of claim 16 further comprising adapting the bandwidth and the integration time of all of the time-frequency tiles to provide a plurality of channels each having a coherent time-bandwidth product.

The use of time-frequency tiles having a coherent time-bandwidth product is discussed above in greater detail. This claim simply states the notion readily apparent to one of ordinary skill in the art that more than one of the time-frequency tiles may have a coherent time-bandwidth product. This plurality of channels is also described in the

[24] U.S. App. No. 60/188,084, page 1.
[25] U.S. App. No. 60/188,084, page 1.
[26] U.S. Pub. No. 02/0136276, par. [0023].

specification as a plurality of sub-bands of the signal space: "The channel is partitioned into sub-bands, each with limited coherent integration bandwidth."[27]

Claim 22 recites:

> 22. The method of claim 16 wherein all of the time-frequency tiles have a common bandwidth and a common integration time.

This claim simply recites a possible arrangement of the otherwise arbitrarily scaled time-frequency tiles into a regular pattern of common dimensions for each tile. This is depicted for example in the figure on page 2 of the provisional application which shows consistent, regular dimensions for a number of adjacent time-frequency tiles. At least one concrete example is also provided of the degenerate case for a time-frequency tile: "[E]ach subband can become a single frequency bin integrated over a full data bit time…."[28]

Claim 23 recites:

> 23. The method of claim 16 wherein adapting at least one of the bandwidth and the integration time includes changing at least one of the bandwidth and the integration time between a plurality of bursts of data transmission.

This claim simply asserts that the aspects of a time-frequency tile can change or vary, with reference to specific parameters that can be varied between units of data transmission.

Claim 24 recites:

> 24. The method of claim 16 wherein an actual phase coherency of a channel is determined according to one or more of experiment, radio frequency monitoring, and an estimate for an environment.

This language finds support at least in the figure on page 1 of the provisional application, and was shown earlier, which has text that describes this concept and is repeated below:

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[27] U.S. App. No. 60/188,084, page 2; U.S. Pub. No. 02/0136276, par. [0034].
[28] U.S. App. No. 60/188,084, page 2; *see also* U.S. Pub. No. 02/0136276, par. [0034].

Sub-band size selected for **phase coherency**
- Set by **environment, experiment**, possibly learned by **RF monitoring**[29]

Claims 25 – 29: no support requested.

Claim 30 recites:

30. The method of claim 16 wherein the transmit signal carries the data signal at a magnitude substantially within a noise floor for the signal space.

This language finds support at least in the statement "Further, FFT's offer other significant benefits, such as a **featureless** gaussian **noise-like waveform**."[30]

Claim 35 recites:

35. A device comprising:
a data source providing a data signal;
a transmitter adapted to create a waveform for a signal space including a range of frequencies, the waveform organized into a plurality of sub-bands, each one of the plurality of sub-bands defined by one of a plurality of time-frequency tiles characterized by a bandwidth and an integration time, the waveform including a preamble that includes the bandwidth and the integration time of the plurality of time-frequency tiles, the transmitter further adapted to adjust the bandwidth and the length of time of one of the time-frequency tiles to provide a channel having a tile size selected to maintain a predetermined phase coherency across the time-frequency tile; and
a modulator adapted to modulate the data signal onto the waveform using direct sequence spreading for each one of the plurality sub-bands, thereby providing a transmit signal;
wherein the transmitter is further adapted to transmit the transmit signal into the signal space.

This language finds support at least in the same sections as those described earlier as supporting claims 16 and 17.

Claim 36 recites:

[29] U.S. App. No. 60/188,084, page 1 figure, fourth primary bullet (emphasis added).
[30] U.S. Pub. No. 02/0136276, par. [0036] (emphasis added).

> 36. The device of claim 35 wherein the waveform includes a preamble including an indication of the bandwidth and the integration time of at least one of the plurality of time-frequency tiles.

This language finds support at least in the same sections as those described earlier in supporting claim 17.

Claim 37 recites:

> 37. The device of claim 35 wherein the transmitter is further adapted to adjust the bandwidth and the integration time of all of the time-frequency tiles to provide a plurality of channels each having a coherent time-bandwidth product.

This language finds support at least in the same sections as those described earlier in supporting claim 21.

Claim 38 recites:

> 38. The device of claim 37 wherein all of the time-frequency tiles have a common bandwidth and a common integration time.

This language finds support at least in the same sections as those described earlier in supporting claim 22.

<u>Summary</u>

In view of the foregoing detailed itemization of where in at least the provisional application support appears for the current claim language, the applicant respectfully requests that the claim rejections based upon 35 USC 112 be reconsidered and withdrawn.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue, or comment does not signify agreement with or concession of that rejection, issue, or comment. In addition, the arguments made above may not be exhaustive. Thus, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim,

except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Applicant believes that the Claims are in condition for allowance. A Notice to this effect is respectfully requested.

The Commissioner is hereby authorized to charge any deficiencies or credit any overpayments to Deposit Account No. 50-4262 in order to have this Amendment considered.

Respectfully submitted,

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